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In response to: “Temperature monitoring with zero-heat-flux technology in neurosurgical patients”

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To the Editor,

We appreciate the interest and comments by Menzel and Bräuer [1] on our study “The focus of temperature monitoring with zero-heat-flux technology (3M Bair-Hugger): a clinical study with patients undergoing craniotomy [2].”

Menzel and Bräuer focus on an intriguing and important question: what is the brain temperature? All clinically used temperature measurement sites (nasopharynx, esophagus, tympanum, pulmonary artery, jugular bulb, bladder, rectum) are extracranial, remote to the brain. It is known that the direct brain tissue temperature, obtained invasively under diverse circumstances (e.g. neurosurgery, intensive care and deliberate hypothermia), may be higher than the systemic core temperature [3, 4]. On the other hand, inconsistent and unpredictable individual brain-body temperature differences and reversal of the temperature gradient of brain injury and neurosurgical intensive care patients have been reported [5, 6].

Menzel and Bräuer [1] report unique data on six neurosurgical intensive care patients, in whom the zero-heat-flux thermometry could be compared with concomitant temperature measurements obtained by implanted brain tissue temperature probes. The brain tissue temperature was 0.49 °C higher than the zero-heat-flux or bladder temperatures. The zero-heat-flux or bladder temperatures, on the other hand,

were equal. This indicates that in neurological patients at risk of brain damage, deeper brain temperature monitoring may offer valuable additional information.

However, even the concept of “the brain temperature” is not unequivocal. Different temperatures at different sites of the brain parenchyma have been reported [7]. Even in a condition of an intact skull, non-invasively with magnetic resonance spectroscopy measured brain temperature in the frontal lobe was 0.5 °C lower than the temperature in the thalamus [8]. Cooling effect of craniotomy may further confound interpretation of local brain temperature measurements. There is a cortical temperature gradient at the site of craniotomy [9, 10].

The zero-heat-flux thermometry on the forehead seems to reach the core temperature compartment of the body. Thus, the zero-heat-flux system placed on the forehead estimates accurately enough core temperature of elective neurosurgical [2], as well as gynecological [11], vascular [12], cardiac [12, 13], and abdominal [14] surgical patients. In the craniotomy patients of our study [2], invasive brain temperature monitoring was neither necessary nor ethically acceptable. According to the data by Menzel and Bräuer, the temperature measured invasively deeper in the brain was higher than the zero-heat-flux temperature on the forehead. We agree with Menzel and Bräuer that the zero-heat-flux temperature on the forehead should not be regarded as “the brain temperature”. We further agree that in case of severe brain injury or pathology, conventional core or zero-heat-flux thermometry should be completed with direct measurement of brain temperature [15].

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References

1. Menzel M, Bräuer A. Temperature monitoring with zero-heat-flux technology in neurosurgical patients. Clin Monit Comput.

2019. <https://doi.org/10.1007/s10877-019-00274-3>. (Epub ahead of print).
2. Pesonen E, Silvasti-Lundell M, Niemi TT, Kivisaari R, Hernesniemi J, Mäkinen MT. The focus of temperature monitoring with zero-heat-flux technology (3M Bai-Hugger)—a clinical study with patients undergoing craniotomy. *J Clin Monit Comput*. 2018. <https://doi.org/10.1007/s10877-018-0227-z>. (Epub ahead of print).
3. Whitby JD, Dunkin LJ. Cerebral, oesophageal and nasopharyngeal temperatures. *Br J Anaesth*. 1971;43:673–6.
4. Møllergård P, Nordström CH. Intracerebral temperature in neurosurgical patients. *Neurosurgery*. 1991;28:709–13.
5. Childs C, Vail A, Protherone R, King AT, Dark PM. Differences between brain and rectal temperature during routine critical care of patients with severe traumatic brain injury. *Anaesthesia*. 2005;60:759–65.
6. Fountas KN, Kapsalaki EZ, Feltes CH, Smisson HF, Johnston KW, Grigorian A, Robinson JR. Disassociation between intracranial and systemic temperatures as an early sign of brain death. *J Neurosurg Anesthesiol*. 2003;15:87–9.
7. Møllergård P. Intracerebral temperature in neurosurgical patients: intracerebral temperature gradients and relationships to consciousness level. *Surg Neurol*. 1995;43:91–5.
8. Corbett R, Laptok A, Weatherall P. Noninvasive measurements of human brain temperature using volume-localized proton magnetic resonance spectroscopy. *J Cereb Blood Flow Metab*. 1997;17:363–9.
9. Nakagawa K, Hills NK, Kamel H, Morabito D, Patel PV, Manley GT, Hemphill JC 3rd. The effect of decompressive hemicraniectomy on brain temperature after severe brain injury. *Neurocrit Care*. 2011;15:101–6.
10. Stone JG, Goodman RR, Baker KZ, Baker CJ, Solomon RA. Direct intraoperative measurement of human brain temperature. *Neurosurgery*. 1997;41:20–4.
11. Iden T, Horn EP, Bein B, Böhm R, Beese J, Höcker J. Intraoperative temperature monitoring with zero heat flux technology (3M SpotOn sensor) in comparison with sublingual and nasopharyngeal temperature: an observational study. *Eur J Anaesthesiol*. 2015;32:387–91.
12. Mäkinen MT, Pesonen A, Jousela I, Päiväranta J, Poikajärvi S, Albäck A, Salminen US, Pesonen E. Novel zero-heat-flux deep body temperature measurement in lower extremity vascular and cardiac surgery. *J Cardiothorac Vasc Anesth*. 2016;30:973–8.
13. Eshraghi Y, Nasr V, Parra-Sanchez I, Van Duren A, Botham M, Santoscoy T, Sessler DI. An evaluation of a zero-heat-flux cutaneous thermometer in cardiac surgical patients. *Anesth Analg*. 2014;119:543–9.
14. Boisson M, Alaux A, Kerforne T, Mimoz O, Debaene B, Dahyot-Fizelier C, Frasca D. Intra-operative cutaneous temperature monitoring with zero-heat-flux technique (3M SpotOn) in comparison with oesophageal and arterial temperature. A prospective observational study. *Eur J Anaesthesiol*. 2018;35:825–30.
15. Childs C, Lunn KW. Clinical review: brain–body temperature differences in adults with severe traumatic brain injury. *Crit Care*. 2013;17:222.

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